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Exchange Rates in Portugal 1973-1978: A Portfolio Model of an Inconvertible Currency

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Introduction

The flexible exchange rate regime that has prevailed among industrial countries for most of the decade has been accompanied by a continuing increase in interdependendependence, in particular through international financial intermediation. In such an environment, most open, semi-industrialized, economies have found it difficult to either remain pegged to a major currency or float. This has probably reinforced the authorities' attempts to restrict the access to the foreign exchange market for capital account and even for current account transactions.

In other words, the currencies of these countries have in general remained inconvertible. This does not imply that the authorities have complete control over the price of foreign currency. Exchange rate policy has, indeed, become more difficult to enforce than it was under fixed rates. To begin with, pegging to one major currency means floating relative to other major currencies. More importantly for our purposes, the geographical domain of high capital mobility has widened, so that the inconvertibility of the domestic currency generates stronger incentives for the development

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*Lecturer, Department of Economics and Economic Growth Center, Yale University. This paper extends and revises Section III.3 of Essay III of my Ph.D. dissertation. I am grateful to the members of my committee, in particular to Albert Fishlow, for encouraging further thought on the topic. Errors are my own.

of a "parallel" foreign exchange market and a "black market" exchange rate.

Aside from the enforcement aspect, exchange rate policy in this context is also more difficult to understand conceptually because models of the balance of payments relying on the assumption of a fixed (official) price of foreign currency are as inadequate as models of freely flexible rates.

The conventional monetary model of the exchange rate is particularly inadequate when the lack of availability of domestic assets other than money encourages domestic residents to diversify their financial portfolios by holding foreign assets.

The portfolio approach to flexible exchange rates, on the other hand, assumes a fairly sophisticated financial structure which can be reduced to two moneys when the country is financially underdeveloped. Furthermore, when the central bank varies the official exchange rate according to some set of discretionary rules and at the same time has an extended control over the official foreign exchange market, the determination of the black market rate by portfolio equilibrium, which takes the official rate as given at each instant of time, has to be adapted in order to incorporate the linkages between the two markets.

In this paper a two country portfolio balance model is developed, drawing on the extension of the Tobin (1969) framework to the open economy and in particular on the Kouri (1975) approach to flexible exchange rates as extended to two countries in Kouri-Macedo (1978). The model incorporates inflation in both countries along the lines suggested in Kouri (1978)

and is extended to a situation of currency inconvertibility along the lines suggested in Macedo (1979_b).

The model yields an estimable equation for the black market rate, which is contrasted with the monetarist approach to flexible exchange rates using the same expectations formation mechanism. The estimated equation also provides a test on whether the reaction function used to set the official exchange rate in inspired on relative purchasing power parity considerations.

The model is tested using quarterly data on the black market rate of the Portuguese escudo against the U.S. dollar from 1973;1, when the Bank of Portugal ceased to defend the Smithsonian parity of the escudo, to 1979;1, the last quarter of the standby agreement with the IMF, and also the latest available data.

To test a model over a period where the economy experienced severe external and internal real shocks and also several changes in exchange rate policy involves a strong maintained hypothesis that the basic mechanism at work can be captured econometrically, since various out-of-sample forecasts suggest structural breaks. But the overall fit and the precision of the estimates of the complete model and a simplified version thereof are sufficiently remarkable to warrant the use of models of this type in analyzing exchange rate determination in semi-industrialized economies with inconvertible currencies.

The paper is divided into two sections, followed by a brief conclusion and a data appendix. Section I contains the model and Section II the empirical results. Before starting the analysis, we summarize the macroeconomic adjustment process in Portugal over the last five years.

After the March 1973 decision the escudo was allowed to revalue against the dollar. In the Fall, however, the "oil crisis" increased the foreign currency price of imports and, despite substantial nominal wage increases in 1974 and 1975, the price of nontraded goods in terms of imports did not increase until 1976. This was due not only to the pegging of the exchange rate but also to the increase in the real wage. Both deteriorated the current account and led to a loss in reserves that was not offset by domestic credit creation until 1976.

After some attempts in the first half of 1976, an active policy of depreciation was initiated with an 18 percent effective devaluation in February 1977. This led to an increase in prices and a decline in the real wage, but the credit to the government and the external deficit continued to increase. Despite another effective devaluation of 4 percent in late August, followed by the announcement of a crawling peg to a basket currencies, at the rate of 1 percent per month on an average, the current account continued to worsen until mid 1978. At the same time, domestic credit expansion--often used for the stockpiling of foreign goods--was leading to a further drain in reserves, and made extra financing inevitable.

A stand-by agreement with the IMF was thus concluded on May 5 1978, whereby the escudo was devalued by 7 percent, interest rates were substantially increased and the rate of crawl was established at 1.25 percent per month. The current and capital accounts quickly improved in the following quarters and the rate of crawl was back to 1 percent in April 1979. However, the deficit of the public sector in 1979 could be as high as $2.2 billion, leaving doubts about the duration of the improvement in external balance if public finances are not brought under control.

1. The Model

1. Consider a world of two countries who trade goods as well as non-interest bearing financial assets, money for short.[1] Private financial wealth in both countries is thus divided between domestic and foreign money. The real asset demand functions have as arguments the expected change in the real exchange rate, which captures the return differential; domestic real output, which captures the transactions needs and real financial wealth.

This two-way currency substitution model can be written as follows

$$(1) \quad \frac{eF^d}{P} \equiv f(\overset{+}{\pi}, \overset{-}{y}, \overset{+}{A}) = \frac{eF}{P}$$

$$(2) \quad \frac{M^d}{P} \equiv m(\overset{-}{\pi}, \overset{+}{y}, \overset{+}{A}) = \frac{M}{P}$$

$$(3) \quad AP \equiv W \equiv M^T - G + eF$$

$$(4) \quad \frac{G^d}{eP^*} \equiv g(\overset{-}{\pi}, \overset{-*}{y}, A^*) = \frac{G}{eP^*}$$

$$(5) \quad \frac{H^d}{P^*} \equiv h(\overset{+}{\pi}, \overset{+*}{y}, \overset{+*}{A}) = \frac{H}{P^*}$$

$$(6) \quad A^*P^* \equiv W^* \equiv H^T - F + G/e$$

where e is the domestic currency price of foreign currency

$P(P^*)$ is the domestic (foreign) price level

π is the expected rate of change in $e_r = eP^*/P$, the real exchange rate

$A(A^*)$ is domestic (foreign) private real wealth

$y(y^*)$ is domestic (foreign) real output

$M^T(H^T)$ is the domestic (foreign) money stock

M(H) is the domestic (foreign) money stock held by domestic (foreign) residents

F(G) is the foreign (domestic) money stock held by domestic (foreign) residents, denominated in foreign (domestic) currency.

The signs over the arguments of the assets demand functions refer to their partial derivatives.[2] If domestic residents are not net debtors in foreign currency, $F^d > 0$ and an expected depreciation of the domestic currency increases the demand for foreign assets by domestic residents and decreases the demand for domestic assets by foreign residents, with a decrease in the demand for domestic assets by domestic residents and an increase in the demand for foreign assets by foreign residents of the same amount. For example

$$f_\pi = - m_\pi$$

An increase in real wealth at home or abroad is distributed among the two assets so that, for example

$$f_A + m_A = 1$$

By (1) and (4) the desired net nominal capital outflow in foreign curreny, $\dot{F}^d - \dot{G}^d/e$, is always equal to the actual capital outflow. Thus, substituting (3) in (1) and (6) in (4), differentiating the asset demand functions and rearranging, we get an expression for the nominal capital outflow corrected for capital gains and losses as a function of the

proportional rate of real appreciation, the proportional change in the real money stocks and real outputs at home and abroad, and expectations changes, namely

$$(7)\quad [\dot{F} - \frac{\dot{G}}{e} - (F\hat{P}^* - \frac{G}{e}\hat{P})]\,(1 - f_A - g_A^*) =$$

$$- \hat{e}_r\,[F\,(1 - f_A) + \frac{G}{e}\,(1 - g_A^*)] + f_A\,\frac{M^T}{e}\,\hat{\bar{M}}$$

$$- g_A^*\,H^T\,\hat{\bar{H}} - F\,\eta_y^f\,\hat{y} + \frac{G}{e}\,\eta_{y^*}^{g}\,\hat{y}^* + (F\,\eta_\pi^f + \frac{G}{e}\,\eta^g)\hat{\pi}$$

where a hat ($\hat{}$) over a variable denotes a proportional change,

$f_x = \partial f/\partial x$ denotes the partial derivative of function f with respect to argument x

$\eta_x^f = |f_x|\ x\ f$ denotes the (positive) elasticity of function f with respect to argument x

$\bar{M} = M^T/P$

$\bar{H} = H^T/\ P^*$

Balance of payments accounting implies that the difference between the real excess supply of foreign currency from the currency account surplus and the real excess demand for foreign currency implied by the real capital outflow has to be equal to the real change in the stock of foreign assets of the central bank or

$$(8)\quad \bar{B} - \dot{\bar{F}} = \dot{\bar{G}}/e_r \equiv \dot{\bar{F}}^G$$

where $\bar{F} = F/P^*$

$\bar{G} = G/P$

$\bar{F}^G = F^G/P^*$ is the real stock of foreign assets of the central bank

$\bar{B}$ is the real current account surplus expressed in foreign currency.

From (8) the nominal current account, net of changes in the stock of foreign assets of the central bank corrected for capital gains due to foreign inflation can be expressed as

$$(9)\quad \bar{B}P^* - (\dot{F}^G - F^G\hat{P}^*) = \dot{F} - \frac{\dot{G}}{e} - (F\hat{P}^* - \frac{G}{e}\hat{P})$$

Substituting for the right hand side from (7), we get the net current account as a function of the determinants of the net capital outflow, and solving for the change in the real exchange rate we obtain

$$(10)\quad \hat{e}_r = -(B\bar{P} - \dot{F}^G + F^G\hat{P}^*)(1 - f_A - g_A^*)/I$$

$$+ f_A\mu\bar{M} - g_A^*\nu\bar{H} - \phi^y\hat{\eta} + \phi^{y^*}\phi y^* + \Pi\hat{\pi}$$

where $I = F(1 - f_A) + \frac{G}{e}(1 - g_A^*)$ is the gross level of foreign investment weighted by the wealth propensities

$\mu = M^T/eI$

$\nu = H^T/I$

$$\phi^{y} = \frac{F}{I} \eta_{y}^{f}$$

$$\phi^{y*} = \frac{G}{eI} \eta_{y}^{g*}$$

$$\Pi I = F \eta^{f} + \frac{G}{e} \eta_{\pi}^{g}$$

If $I > 0$, which would not occur if domestic residents were debtors in foreign currency, we see that the real exchange rate depreciates with real money growth at home and appreciates with real money growth abroad, whilst it appreciates with real output growth at home and depreciates with real output growth abroad. An increase in the expected rate of depreciation of the real rate also depreciates the real rate. Given the elasticities of the asset demand functions with respect to π, the coefficient on $\hat{\pi}$ will be smaller the higher the wealth effects f_A and g_A^*. The effects of output growth are also less than the respective elasticities.

The critical condition can be seen in the coefficient of the first term. A net current account surplus will be associated with a real appreciation of the exchange rate if the "transfer condition" holds, or

$$1 - f_A - g_A^* > 0$$

This implies that the domestic wealth-induced increase in the demand for domestic assets by domestic residents ($m_A = 1 - f_A$) has to be larger than the foreign wealth-induced increase in the demand for

domestic assets by foreign residents (g_A^*), or alternatively that $h_A = 1 - g_A^* > f_A$. When the level of gross foreign investment is positive ($I > 0$), the stability condition is thus that domestic currency is the "Preferred monetary habitat".[3]

Under stationary expectations ($\hat{\pi} = 0$), equation (10) provides a complete description of the determination of the change in the real exchange rate. If the dependence of the real current account on relative prices is made explicit, the "transfer condition" is supplemented by an "elasticities condition" and the long run value of the real exchange is such that the real net stock of foreign assets is constant and there is no intervention.

2. To adapt equation (10) to a regime of currency inconvertibility where there are continuous changes in the official exchange rate, as well as in the reserves of the central bank, we first need to specify how these affect the expected rate of change of the black market real exchange rate.

One simple and plausible specification of π is that it is a negative function of the black market premium and the stock of central bank reserves.

If the official rate depreciates the black market rate depreciates as well but if the black market rate depreciates given the official rate, then it is expected to appreciate. This is, of course, equivalent to assuming extrapolative expectations with respect to the real official rate and regressive expectations with respect to the real black market rate. The assumption of the same elasticity is merely a matter of convenience.

If reserves go up, the real black market exchange rate will be expected to appreciate. One could argue that it could equally well depreciate because, at a given supply, there is a greater demand for foreign assets by domestic residents, including the central bank. The mechanism present in equation (10) is that an increase in real reserves increases the actual rate of real depreciation, in the same way that an expected appreciation (from the increase in F^G) would. The argument about the direct effect of changes in F^G on expectations is, however, that in a regime where there is intervention and administrative exchange rate changes in the official market, the strength of the currency in that market has an effect on the expected rate of change in the real black market rate. The assumption is that this effect occurs in both the premium and central bank reserves and the irrelevance of valuation changes on central bank reserves for monetary policy suggests that the nominal stock should be used.

In sum we postulate a πfunction of the form

$$(11) \quad \pi = \pi (\bar{p}, \bar{F}^G)$$

where $p = e/\tilde{e}$ is the black market premium.

Changes in nominal central bank reserves do have an effect on the rate of growth of the domestic nominal money stock, assuming away the foreign central bank. In fact, the domestic money stock is defined at

$$M^T = C + \tilde{e}F^G - K$$

where C is domestic credit of the banking system to the private sector and K is the net worth of the banking system.

Assuming that official foreign exchange reserves are not affected either by changes in valuation deriving from official exchange rate changes, the sources of domestic money growth are given by

$$(12)\quad \hat{M}^T = \frac{D}{M^T} + \frac{\tilde{e}\dot{F}^G}{M^T}$$

where $D = \dot{C}$ is domestic credit creation by the banking system.

Substituting (12) and the log differential of (11) into (10) and collecting terms we get an expression for the proportional rate of change in the black market rate.

$$(13)\quad \hat{e} = \hat{\tilde{e}} - \mu\,(1 - f_A - g_A^*)\,\frac{\bar{B}P^* + F^G\hat{P}^*}{M^T/e} + f_A\,\mu\,\bar{d}$$
$$- \theta\tilde{\mu}\frac{\tilde{e}\dot{F}^G}{M^T} - g_A^*\,\nu\,\hat{\bar{H}} - \phi^y\,\hat{y} + \phi^{y*}\,\hat{y}^* - \frac{I}{\tilde{I}}\,\hat{\tilde{e}}_r$$

where $\mu = M^T/e\tilde{I}$

$\tilde{\mu} = M^T/\tilde{e}\tilde{I}$

$\nu = H^T/\tilde{I}$

$\tilde{I} = F(1-f_A + \eta_\pi^f\,\eta_p^\pi) + \frac{G}{e}\,(1 - g_A^* + \eta_\pi^g\,\eta_p^\pi)$

$\bar{d} = D/M^T - \hat{P}$

and $\theta = (f_\pi/e_r + g_\pi/p)\,\pi_F G - (1 - f_A - g_A^*) - f_A/p$

It is useful to collect the terms arising from the behavior of monetary authorities as defined in an "exchange rate pressure" variable[4] which is positive whenever either the official rate depreciates ($\hat{\tilde{e}} > 0$) or the central bank looses reserves ($\dot{F}^G < 0$) and negative when the official currency is "strong" ($\tilde{e} < 0$ or $\dot{F}^G > 0$). The size of the pressure as measured increases with the premium and the strenght of the expectations effects. Aside from the effects of the growth in the real domestic credit and the foreign money stock, which are given by the wealth propensities weighted by the ratio of the stocks to the level of international investment adjusted for expectations ($\tilde{I}$), and the effects of real output growth at home and abroad, which are given by the income elasticites of money demand weighted by the ratio of the assets and liabilities, respectively, and $\tilde{I}$, equation (13) implies that, both when $\tilde{I},\theta > 0$ and $\tilde{I},\theta < 0$ the effect of official exchange market pressure will be to depreciate the black market rate. Also, if the transfer condition holds and $\tilde{I} > 0$ the current account will be negatively related to the black market premium, that is to say that will be positively related to the official exchange rate.

In fact, taking the official real exchange rate as given and assuming that the real current account depends only on the black market premium, we find from taking a linear approximation to (13) around equilibrium when $p = 1$ that

$$\dot{p} = \{-(1 - g_A^* - f_A)\mu\left[(1 + \eta_p^b)\frac{\tilde{B}P^* + F^G\hat{P}^* + \theta\tilde{e}F^G}{M^T/e}\right] + Z\}(p - 1)$$

where $\bar{B}$ is the long run real current account and Z are the exogenous variables in (13).

If the increase in the premium deteriorates the real current account and $\eta_p^b < 0$ a deficit will be associated with an increase in the premium, and, if $\theta > 0$ a decline in foreign exchange reserves will be associated with an increase in the premium. In a more detailed analysis, the "true" current account could be divided into a reported component, where $\eta_p^b < 0$ and an unreported current account, where $\eta_p^b > 0$.[5] Since we only observe the reported current account, there is a possibility that the negative elasticity will overtake the "transfer condition".

Another feature of (13) above is that real official exchange rate depreciation reduces the black market premium directly rather than via the gain in competitiveness. The effect has an upper bound of 1, when the expectations elasticities in I are negligible. If official exchange rate policy is based on a PPP rule, $\hat{\tilde{e}}_r = 0$ and the real exchange rate does not affect the black market premium, which is then defined as the departure of the black market rate from relative PPP.

Before proceeding to estimate equation (13) in the case of the escudo-dollar rate, it should be emphasized how the condition of equilibrium in the foreign exchange market that underlies the equation differs from the monetarist approach to exchange rate flexibility. There, in fact, perfect goods arbitrage fixes the real exchange rate and thus makes the change in the nominal rate a function of "excessive" monetary growth[6] at home and abroad.

Using (2) and (5) above, ignoring the wealth effects and using (11) and (12), we obtain a monetarist alternative to (13) as:

$$(14)\quad \hat{e} = \tilde{\hat{e}} + \frac{1}{1+\eta^P}\left[\bar{d} - \bar{H} - \tilde{\phi}^y\,\tilde{y} + \tilde{\phi}^{y*}\,\hat{\eta}^* - \tilde{\hat{e}}_r\right] - \tilde{\theta}\frac{\tilde{eF}^G}{M}$$

where $\eta^P = (\eta^m_\pi + \eta^h_\pi)\eta^\pi_p$

$$\tilde{\phi}^y = \frac{eF}{M}\,\eta^f_y$$

$$\tilde{\phi}^{y*} = \frac{G}{eH}\,\eta^g_{y*}$$

and $\tilde{\theta} = (f_\pi/\tilde{e}_r - \frac{M}{eH}\,p\,g_\pi)P^*\pi_F{}^G - 1$

Note that we have substituted for the partials using Tobin's laws, so that we could use the same elasticities as in (13).

Even though the expectation formation mechanism used in (13) and (14) is not in the monetarist tradition, and the relative opportunity costs of holding money are generally solved out for the forward premium, the crucial difference of no trade in money is, of course, the irrelevance of the current account, and the strong proposition that, except for the expectations elasticity term, there is a coefficient of 1 for $\bar{d}$ and $\bar{H}$.

In the next section we do not explicitly test the two alternative specifications, but in the process of estimating (13) the relevance of the portfolio approach will clearly emerge.

2. Estimation

The main difficulty in estimating equation (13) has to do with the absence of data on black market transactions. It is believed that the reported current account of Portugal includes, via underinvoicing of exports and overinvoicing of imports. unauthorized capital flows and also that there was substantial capital flight during the period. The use of the reported current account net of change in the foreign assets of the banking system, while it underestimates the total capital account insofar as the exclusion of the faked current account transactions and capital flight is concerned, overestimates it insofar as foreign direct investment and long term capital account transactions of the public sector are included. Also there are no gross data on short term private capital flows, so that the use of the series on private long term capital outflows to generate the stock of foreign assets does not allow for short term borrowing in foreign currency by the private sector, even though this is believed to have taken place.[7]

We therefore decided to take the ratios involving the stocks of foreign asset and liabilities of the private sector as parameters.

We then have as independent variables in the regression of the change in the end of period black market rate in percent per quarter (series 20 in the Appendix) the change in the end of period official rate (series 18) the change in the real end of period official rate (series 19), the changes in industrial production in Portugal (series 21) and the U.S. (series 22) as proxies for real incomes, all in percent per quarter, domestic credit creation as a proportion of the money supply less the domestic rate of inflation (series 24), real money growth in the U.S. (series 23), the current

account (series 27) and the capital gains and losses on the stock of foreign assets of the banking system due to U.S. inflation (series 29) both as a proportion of the money supply valued at the black market rate, and the balance on non-monetary transactions as a proportion of the money supply valued at the official rate as the "foreign monetary base" (series 25). The constant in the regression can be interpreted as the unreported current account.

The results of the estimation of this equation with quarterly data using ordinary least squares can be found in Table 1.

The fit is reasonable, with over 2/3 of the variance of the change in the black market rate explained by the regressors. There is, however, some negative autocorrelation in the residuals and the significance level of the F test is almost 1 percent. The effects of the official rate, credit creation and domestic output growth are quite precisely estimated and, given $F, I, \tilde{I} > 0$, with the expected sign. The real official rate is also of the expected sign but a slightly higher significance level. Foreign money and output growth, together with capital gains and the constant are insignificant and of the wrong sign.

The negative sign of the foreign monetary base would then be an indication that the expectation effect was stronger than the crowding out effect. However, the positive sign of the reported current account suggests that the surplus, by showing less disguissed capital outflows, is associated with an increase in the price of foreign currency, rather than with the expected decrease. The reported current account does, as pointed out above, depend negatively on the level of the black market rate in the model of inconvertibility emphasizing this distinction.

Table 1

Estimation of Equation (13)
By Ordinary Least Squares

Quarterly Data 1973;1 - 1979;1

Variable number and Name in the Appendix	Coefficient	Standard error	t statistic	Mean of variable	Auxiliary R^2
Constant	2.743	4.385	.626	1	.88
26. CABMR	5.714	1.676	3.409	-1.346	.79
29. KLNFAM2	-7.790	6.895	-1.130	.249	.46
18. GOMEB	3.117	1.277	2.442	2.578	.97
25. FMBB	-3.539	1.059	-3.343	-1.045	.62
24. RDCITM2	2.452	1.004	2.443	.030	.85
23. GRM2US	.790	.909	.869	.074	.63
19. GROMEB	-2.299	1.279	1.797	-.642	.97
21. GIP	-2.503	.939	-2.665	1.285	.58
22. GIPUS	-.458	.728	-.630	.847	.42
20. GBMER				2.854	

R^2 = .71 R^2 adjusted for degrees of freedom = .54

Durbin-Watson Statistic = 2.21

Standard error of the regression = 7.65

F statistic (9, 15) = 4.1813 significance level = .7%

Note: Variables 18 through 22 are expressed in percent per quarter. The other variables are expressed as a percentage of the previous period money stock, valued at the black market rate, for series 26 and 29, at the official rate for series 25 and in domestic currency for series 24. See Data appendix for details.

Furthermore, the fact that domestic real money growth has the expected sign shows that, if $\tilde{I} < 0$ and the private sector is net debtor in foreign currency, then we need to have $F^d < 0$ as well and therefore $f_A < 0$. If we ignore g_A^*, the ratio of the coefficients on the current account and domestic credit creation gives an estimate of f_A since μ cancels. The number implied by the coefficients is in fact negative and in the rate of -.97 to -.23, with a point estimate of -.75. This implies that domestic residents are debtors in foriegn currency and want to borrow in foreign currency roughly 3/4 of the increase in their real wealth and that the expectations effects are also reversed, which explains why the coefficient on the real exchange rate is greater than one in absolute value ($|\tilde{I}| < |I|$). The size of the sign on the nominal official exchange rate can only be explained by the rather pronounced multicollinearity, in particular with the real rate.

The autocorrelation is corrected for in Table 2, and even though there is some decline in the value of the coefficients, the significance remains and the fit improves. The implied values for f_A (still with $g_A^* = 0$) have a range between -1.45 and -.45, with a point estimate of -1.22. Strictly speaking, this value is incompatible with a two asset model insofar as it could imply negative wealth in the steady-state.

A plot of the actual and fitted values from the regression in Table 1 can be found in Figure 1. Even though the fit is better with the autocorrelation correction, the interpretation of the plot is easier using the undifferenced data. The drops in the black market rate in 1973; 1; 1973;3; 1975;2 and 1976;1 are not captured by the model. The drops in 1973 are related to the appreciation of the official rate against the dollar after the devaluation of early March. The drop of 1975;2, just before the sample maximum of the "Hot Summer" of 1975; 3 can be explained by the fact that the deterioration of the current account following the March 11

Table 2

Estimation of Equation (13) Correcting for First Order Autocorrelation

Quarterly data 1973;1 - 1979;1

Variable number and Name in the Appendix	Coefficient	Standard error	t statistic	Mean of variable	Auxiliary R^2
Constant	2.614	3.600	.727	1.401	.92
CABMR	4.640	1.504	3.086	-1.915	.85
KLNFAM2	-6.377	5.450	-1.170	.353	.59
GOMEB	3.024	1.091	2.773	3.603	.96
FMB	-2.473	.915	-2.703	-1.494	.72
RDUTM2	2.554	.916	2.788	.094	.85
GRM2US	.630	1.115	.565	.196	.58
GROMEB	-2.188	1.141	-1.917	-.883	.96
GIP	-2.881	.827	-3.483	1.811	.65
GIPUS	-.094	.633	-.148	1.178	.54
GBMER				4.037	
RHO	-.422	.033			

R^2 = .73 R^2 adjusted for degrees of freedom = .57

Durbin Watson statistic = 2.10.

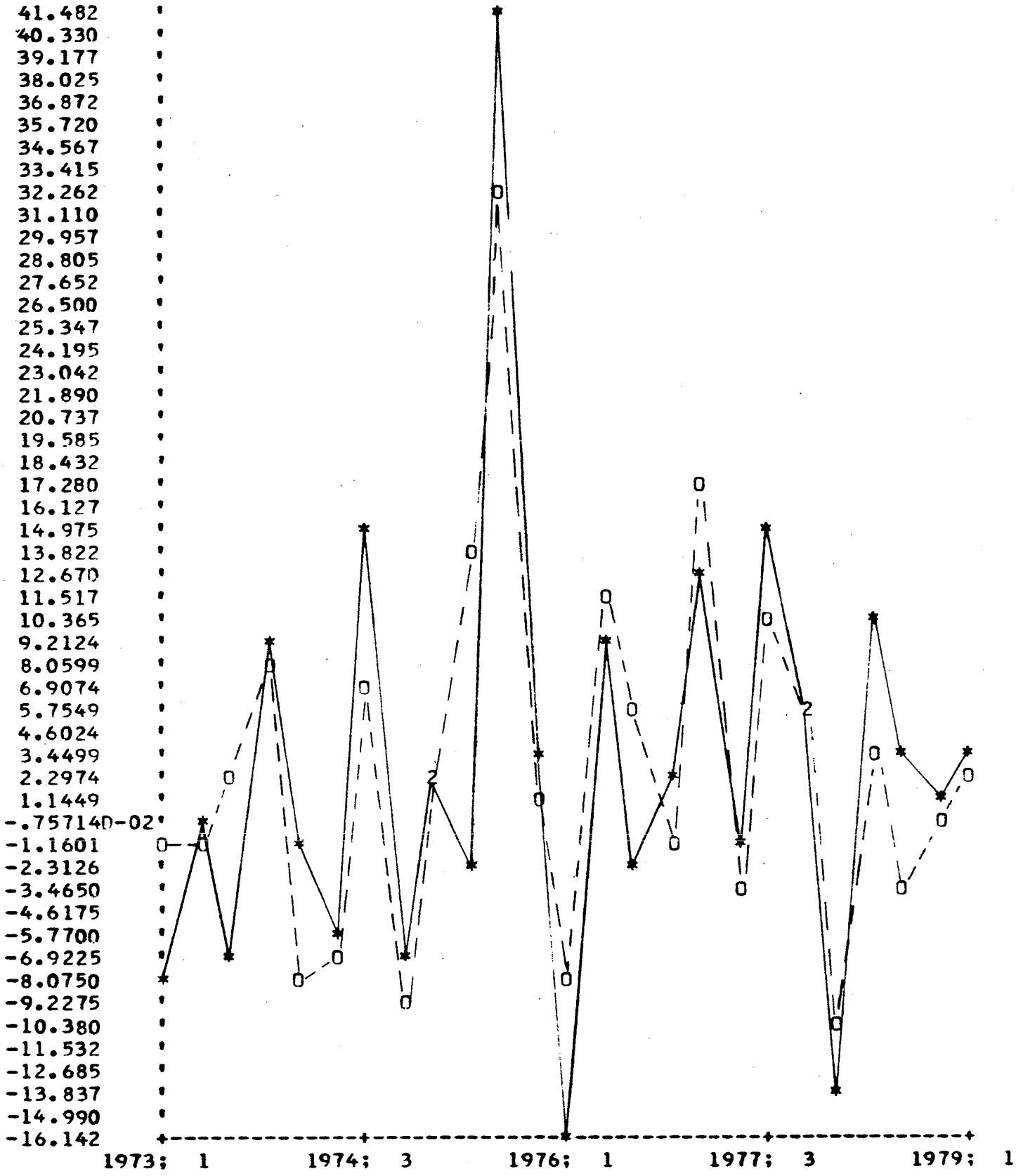
Standard error of the regression = 7.38.

F statistic (9.15) = 4.52 significance level = .5 percent.

Residual Mean = -.049.

Note: Statistics are for differenced data from Table 1.

Actual and fitted values from Table 1



* —— * actual values

0 ---- 0 fitted values

leftist coup, led to further restrictions on capital outflows and the levying of an import surcharge in May. Thus the capital outflow declined in 1975;2 but during 1975;3 it reached over one billion dollars (from $.3 billion), whilst the current account deficit declined from $230 million to $70 million. In 1976; 1 the black market rate fell by about 16 percent as the political situation stabilized. The official rate began to be actively devalued (15 percent in the two quarters), however, and the black market rate increased 9 percent in 1976;2.

The increases in 1977;3 and 1978;2 are also underestimated by the model, since, given its enormous size, the increase of 1975;3 is fairly well predicted. The black market rate increased in the first quarter of 1977 but the premium declined. After the announcement of the crawling peg, however, the premium went up to 10 percent in 1977; 3 and 20 percent in 1977;4, also helped by the fact that the offical rate was lower due to the fall of the dollar in late 1977. In 1978;1 despite further deterioraton in the current account, the black market rate declined by 13 percent to jump up again by 10 percent in the second quarter, possibly because the agreement with the IMF in May, whilst raising domestic interest rates substantially, discontinued forward cover by the central bank. Between these two quarters the current and the capital account reversed from a deficit of $410 and $184 million respectively to a small surplus and an inflow of $400 million respectively.

That the adoption of the crawling peg and the agreement with the IMF involved structural changes in the Portuguese foreign exchange markets is confirmed by the out-of-sample forecasts reported in Tables3 and 4.

In Table 3, the model is estimated using ordinary least squares from 1973;1 to 1977;2 in column A and from 1973; 1 to 1978; 1 in column B and used to predict the remaining values. The regression coefficients are quite sensitive to the period 1977;3 to 1978;1: for the current account, the nominal rate, the "foreign monetary base" and the real rate, the drop in absolute value is about one. The underprediction of the increase in the black market rate is substantial in both cases, and the root mean square error is respectively 5 and 5.4 times the actual mean. The higher value of the Theil inequality coefficient in column B confirms that there was a new break in 1978.

Correcting for autocorrelation, as in Table 4, and using the sample autocorrelation coefficient in the forecast, actually increases the root mean square error and the Theil U in the first experiment, probably due to the increase in the DW after first order negative serial correlation is corrected for. The results in column B are only marginally better than with OLS and we therefore, report in Figure 2 the fitted values over the whole sample period from Table 1 together with the in and out of sample forecasts from column A and B of Table 3.

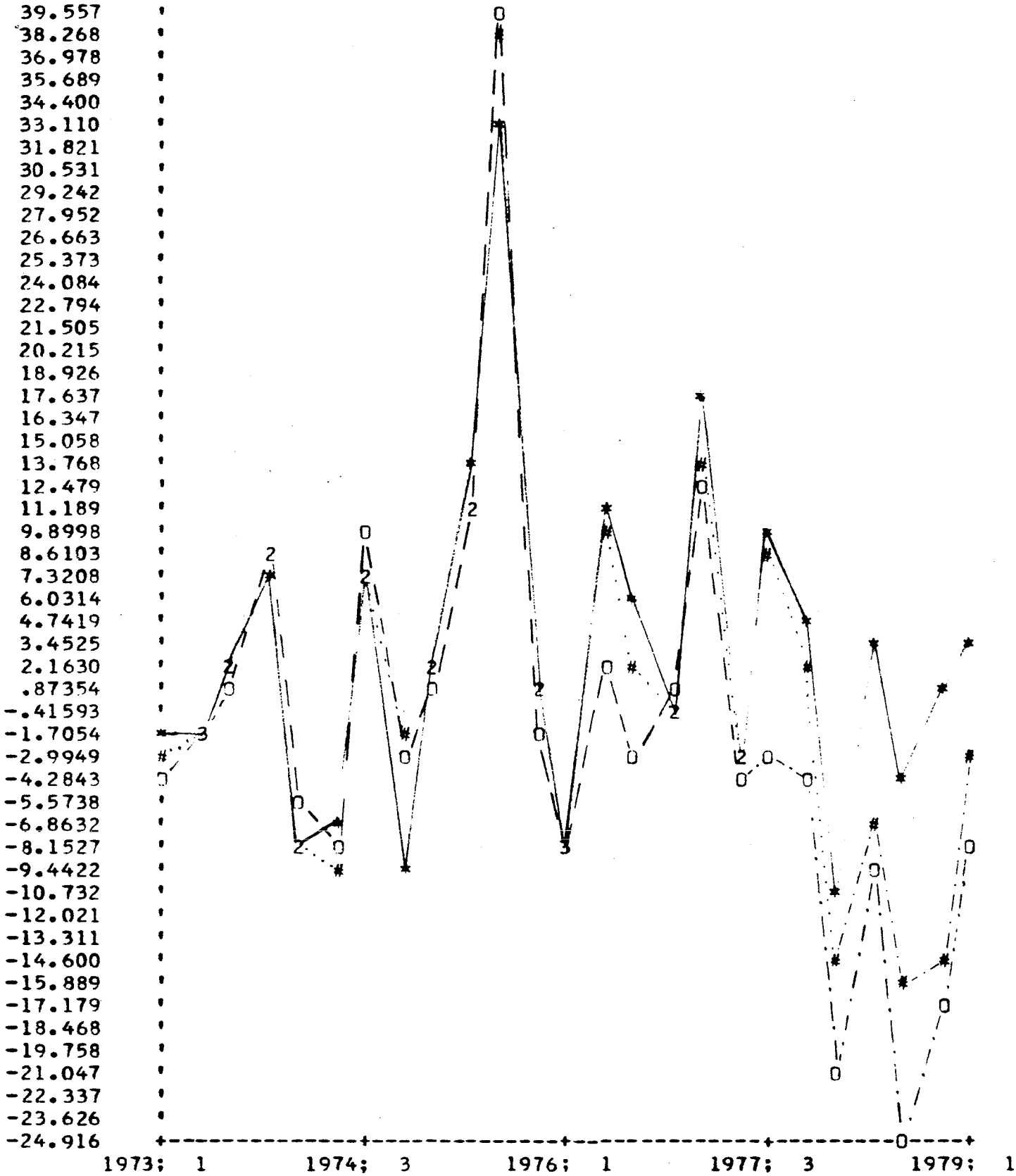
The fitted values are not too different from each other until the devaluation quarter, 1977; 2, but the forecast for the crawling peg period severely underestimates the black market rate. Thus a decline of the fitted value is 10.2 percent and 2.7 percent is predicted for 1977;3, whilst there was a 14.4 percent actual increase. Similarly, the devaluation of 1978;2 is not captured either and a decline of 9.8 percent is predicted when there was a 10 percent increase. For that quarter, the out-of-sample

Table 3

Forecasts from Table 1

	A 1973;1 - 1977;2			B 1973;1 - 1978;1		
	Coefficient	St. Error	t	Coefficient	St. Error	t
Constant	-13.28	8.58	-1.55	-7.66	6.93	-1.11
CABMR	5.96	2.30	2.59	4.77	1.88	2.54
KLNFAM2	12.74	11.70	1.09	6.77	10.21	.66
GOMEB	4.52	1.74	2.60	3.57	1.29	2.77
FMB	-5.60	1.42	-3.96	-4.63	1.18	-3.92
RDCITM2	2.98	1.48	2.01	3.14	1.15	2.74
GRM2US	.66	1.61	.41	-.07	1.35	-.06
GROMEB	-3.87	1.77	-2.18	-3.00	1.34	-2.24
GIP	2.50	1.14	-2.27	2.24	.93	-2.42
GIPUS	-.40	.80	-.51	-.29	.76	-.38
R^2		.82			.80	
R^2 adj. d.f.		.62			.63	
D.W.		2.56			2.15	
S.e.r.		7.62			7.44	
F(d.f.)		4.11 (9,8)			4.84 (9, 11)	
s.l. %		3			.9	
	1977;3 - 1979;1			1978;2 - 1979;1		
Forecast Mean	-12.60			-10.06		
Actual Mean	3.52			4.52		
Root MSE	17.40			15.42		
Theil U	1.95			2.69		

Fitted values and forecasts from the Unrestricted Estimates



* —— * fitted values from Table 1
0 --- 0 fitted values form Table 3 column A
0 -.- 0 forecastsfrom Table 3 column A
... # fitted values from Table 3 column B
-.- # forecasts from Table 3 column B

Table 4

Forecasts from Table 2

	A 1973;1 - 1977;2			B 1973;1 - 1978;1		
	Coefficient	St. Error	t	Coefficient	St. Error	t
Constant	-19.297	6.807	-2.834	-9.242	6.419	-1.440
CABMR	4.477	1.394	3.212	3.307	1.661	1.991
KLNFAM2	18.078	7.878	2.295	8.943	8.904	1.004
GOMEB	5.399	1.197	4.509	3.702	1.154	3.208
FMB	-4.829	950	-5.084	-3.425	.998	-3.433
RDCITM2	3.956	1.120	3.533	3.575	1.102	3.245
GRM2US	-1.304	1.951	-.668	-.669	1.558	- .429
GROMEB	-5.033	1.367	-3.683	-3.249	1.287	-2.525
GIP	-2.886	.714	-4.042	-2.583	.836	-3.089
GIPUS	.551	.551	1.000	.363	.652	.556
RHO	-.776	.022				
R^2 (adj. df)	.91 (.81)			.82 (.67)		
Durbin Watson	2.89			1.91		
Mean GBMER	4.80			4.17		
Mean Residuals	-.112			-.058		
St. error reg.	6.05			7.13		
F(d.f./s.l.)	9.21 (9,8/.3%)			5.59 (9,11/.5%)		
	1977;3-1978;1					
Forecast Mean	-13.4			-8.05		
Actual Mean	3.52			4.52		
Root MSE	18.79			13.55		
Theil U.	2.11			2.37		

Note: The forecast values are corrected for autocorrelation using the in sample estimate of RHO and the residual on the last observation.

forecast of the period of the IMF agreement is a decline of 6.6 percent in 1978; 2. For the following quarter a decline of -15.8 percent is predicted, when the fitted value was -3.9 percent and there was an actual increase of 3.4 percent.

Coming back to the estimation of equation (13) in the preceding section, the insignificance of foreign money and output variables in not too surprising, since the rate with the dollar will depend on trends with other trading partners. As for the capital gains and losses, they are not substantial in magnitude, relative to the current account, and insignificance is not particularly bothersome either.

The insignificance of the constant, interpreted as the unreported current account is more puzzling, but nevertheless clear, as shown by the F tests on simultaneous restictions reported in Table 5. The tests including the constant in the first two rows have lower significance levels --a difference of 7 percent. Another restriction has to do with the construction of our exchange market pressure variable, which is suggested further by the similarity between the absolute value of the coefficients and the sign of the intervention variable. The restriction on the foreign flows are easily accepted, and the insignificance of the money stock may be justified by a negligible g_A^*. Whether the capital gains and the current account have the same coefficient or the former is zero is easily seen by the increase in significance level in the former case, by 13 percent when there is no constant.

It therefore seems adequate to use the restricted regression where the rate of change in the black market rate depends positively on the current account, the official exchange market pressure, real domestic credit

Table 5

Restrictions on the equation in Table 1

Variable number							(1)		(2)	
C	26	29	18	25	23	22	F(d.f)	s.l.	F(d.f.)	s.l
0		0	1	1	0	0	.324 (5,15)	89	10.836 (4,20)	0
0	1	-1	1	1	0	0	.661 (5,15)	66	3.376 (4,20)	0
	1	-1	1	1	0	0	.740 (4,15)	58	7.337 (5,19)	.1
		0	1	1	0	0	.382 (4,15)	82	7.140 (5,19)	0

Note: In all tests the in homogeneous part is zero. Test in column (1) is on the restrictions being simultaneously true
Test in column (2) is on the coefficients of the restricted regression being different from zero.

creation, and negatively on the real official exchange rate and real output growths. The results are shown in Table 6, with and without autocorrelation correction. The Durbin-Watson and the R^2 from an identical equation where the residuals have zero mean are also reported. What is striking is the precision of the estimates even though we are now at at a lower confidence level. Again here autocorrelation is not so large as to justify using the corrected equation. In both cases, furthermore, the implied value of f_A is -1.50 for OLS and -1.66 with the autocorrelation correction, which suggests that this is indeed a simplified equation where the constraint of no incremental foreign demand for domestic assets increases the possibility of dynamic instability in the foreign exchange market.

Comparing the coefficients in the two panels of Table 6 with the unrestricted ones from Tables 1 and 2 above, we see that their size has generally decreased but is within the confidence interval. Thus the OLS effect of the current account in Table 1 was 5.7 whereas the value in the simplified version of Table 6, Panel I, is 4.2. The drop is not as large for "exchange market pressure" which has a coefficient of 2.8, down from 3.1 to 3.5, for real output, 2.14 is absolute value, down from 2.5, or the real exchange rate, 2.1 down from 2.3. In the case of real domestic credit creation the coefficient remains unchanged at 2.5.

The basic statistics of the simplified regression are similar to the ones above, whilst a clear increase in degrees of freedom allows for further forecasting experiments and provides, therefore, another justification for ignoring the insignificant variables.

Table 6

"Restricted" Estimates

I. OLS

Variable Name	Coefficient	St. Error	t	Mean	Aux. R^2
CABMR	4.24	1.05	4.03	-1.35	.70
GOMFMB	2.81	.57	4.92	3.62	.92
ROCITM2	2.53	.57	4.43	.03	.60
GRUMEB	2.05	.62	-3.31	-.64	.90
GIP	2.14	.70	-3.05	1.29	.51
GBMER				2.85	
RESIDUALS				-.24	
STATISTICS	R^2	R^2adj	DW	SER	f (d.f./s.l.)
	.68	.62	2.29	6.98	10.8 (5,20)
(incl. C)	(.69)	(.60)	(2.22)	(7.14)	(8.30) (5,19)
					0 %
					(0 %)

II. AUTO

26.	CABMR	3.73	.96	3.91	-1.699	.62
	GOMFMB	2.58	.50	5.19	4.536	.89
24.	RDCITM2	2.33	.51	4.56	.069	.56
29.	GROMEB	-1.82	.54	-3.38	-.802	.86
21.	GIP	-2.17	.61	-3.55	1.617	.37
	RHO	-.26	.04			
20.	GBMER				3.585	
	RESIDUALS				.110	
	STATISTICS	R^2	R^2 adj.	DW	SER	F (d.f./s.l.)
		.68	.62	1.94	6.81	10.79 (4,20)
		(.63)	(.60)	(1.96)	(6.97)	(8.29) (5,19)
						0 %
						(0 %)

Plots of the restricted OLS estimates from Table 6 show very little difference with the unrestricted ones reported in Figure 1, except in 1973;3 and even more so in 1978;4, when the imposition of restrictions worsens the fit. In the first instance the unrestricted residual is about -10 percent and the restricted residual goes up from 1 percent to 6.5 percent. The overall conformity of the two sets of estimates is, however, the remarkable consequence of the restrictions imposed. However, the OLS forecasts for the period of the crawling peg and of the agreement with the IMF, reported in Table 7, are significantly better in a mean square error sense than the ones of the unrestricted model. Thus the RMSE for 1977;3-1979;1 drops to 5.46 (9.55 when a constant is included) from 18.79 and for 1978;2-1979;1 it drops to 6.84 (10.36 with a constant) from 15.42. The prediction errors for each observation are compared in Table 8 and the better forecasting performance of the restricted model is clear, in particular in 1978;4 when the restricted model had a much higher residual.

As pointed out above, one advantage of the simplified model is that it increases the degrees of freedom. This allows a further test of the model's out-of-sample forcasting performance by the division of the sample into a period with a roughly fixed official exchange rate until the end of 1975 and a period with a depreciating official exchange rate thereafter. This division is somewhat arbitrary because in the second half or 1976 and after between February the 1977 devaluation and the adoption of the crawling peg the official effective exchange rate was virtually fixed, and also because the loss in reserves was quite substantial in the second period. In fact, the usual measure of the relative use of exchange

Table 7

Forecasts from Table 5

	A			B		
	1973;1 - 1977;2			1973;1 - 1978;1		
CABMR	4.446	1.314	3.384	4.537	1.089	4.164
GOMFMB	2.831	.674	4.200	2.915	.586	4.972
RDCITM2	2.460	.813	3.023	2.752	.595	4.621
GROMEB	-2.086	.748	-2.790	-2.200	.639	-3.493
GIP	-2.278	.849	-2.683	-2.391	.735	-3.253
R^2 with constant (adj. for d.f.)	.76 (.66)			.77 (.70)		
Alternative R^2	.715			.75		
D.W. (with constant)	2.62 (2.66)			2.54 (2.48)		
SER	7.74			7.08		
F (d.f.)	6.52 (5,13)			9.41 (5,16)		
s.l.	.3%			0		
Residual Mean	-1.32			-1.12		
Forecast Mean (with constant)	-.22 (-4.8)			-1.21 (-4.87)		
Actual Mean	3.52			4.52		
Root MSE (with constant)	5.46 (9.55)			6.84 (10.36)		
Theil U (with constant)	.61 (1.07)			1.20 (1.81)		

Table 8

Prediction Errors

	1977;3 - 1979;1		1978;1 - 1979;1	
	Unrestricted	Restricted	Unrestricted	Restricted
1977;3	17.10	9.09		
4	10.36	4.94		
1978;1	7.24	2.91		
2	20.23	14.08	17.06	10.45
3	28.33	14.13	19.23	3.41
4	17.94	11.00	15.88	1.32
1979;1	11.61	2.06	6.15	2.90

rate and intervention, obtained by taking the ratio of the proportional exchange rate changes and the change in foreign exchange reserves, scaled by the money supply valued at the official rate, is inadequate in this case because of the piling up of reserves and exchange rate appreciation in 1973. The foreign monetary base only started to decline in 1974;4, and the cumulative change since 1973;1 only became negative with the dip of 7.8 percent in 1975;3. Despite these caveats, the division captures the essence of the adjustment process at work.

Table 9 reports the regressions for the two subperiods and it is evident that, except for the real exchange rate, and to some degree real output growth, the size of the effects of changes in asset stocks is vastly different in the two subperiods. Thus the effect of the current account is 2.54 for the "fixed rate" period, whilst it is 4.24 for the whole period. The size of the effect of exchange market pressure declines from 2.70 to 1.91, but the overall effect is 2.81. Real domestic credit creation, on the other hand, has a small and insignificant effect in the first period and an effect of 2.2 in the second. Overall, the fit is better in the first period, but there is less autocorrelation in the residuals, in the second when the D.W. statistic is computed from a regression with a constant term.

The out of sample performance of the model is, however, better in the second period. The RMSE is 10.2 percent versus 13.5 in the second period and Theil's U is .75 versus 1.50.

Table 10 reports the residuals and the prediction errors of the regression over the whole sample period in column A, of the residual

Table 9

Forecasts and Backcasts

From Table 6

	A 1973;1 - 1975;4					B 1976;1 - 1979;1			
	Coefficient	St. Error	t	Mean	R^2	Coefficient	St. Error	t	Mean
CABMR	2.54	1.75	1.45	-.37	.70	3.92	2.04	1.92	-2.25
GOMFMB	2.70	.67	4.01	1.02	.84	1.91	1.11	1.71	6.02
RDICTM2	.43	1.36	.32	-.28	.79	2.23	.80	2.79	.31
GROMEB	-1.33	.85	-1.58	-2.43	.88	-1.27	1.13	-1.13	1.01
GIP	-.89	1.38	-.65	.59	.74	-.29	1.24	-.23	1.93
GBMER				3.49					2.27
RESIDUALS				-.94					.75
R^2 with constant (adj. d.f.) =	.87 (.76)					.75	(.56)		
R^2 alt.	.84					.73			
D.W. (with constant)	2.43 (2.35)					1.40	(1.83)		
SER	7.15					5.93			
F(d.f.)	7.33 (5.7)					4.40	(5.8)		
	1.1					3.2			
	1976;1 - 1979;1					1973;1 - 1975;4			
FORECAST MEAN	7.62 (6.77)					2.82 (4.86)			
ACTUAL	2.27					3.48			
ROOT MSE	13.51 (15.37)					10.19 (10.99)			
THEIL U	1.50 (1.71)					.75 (.81)			

Table 10

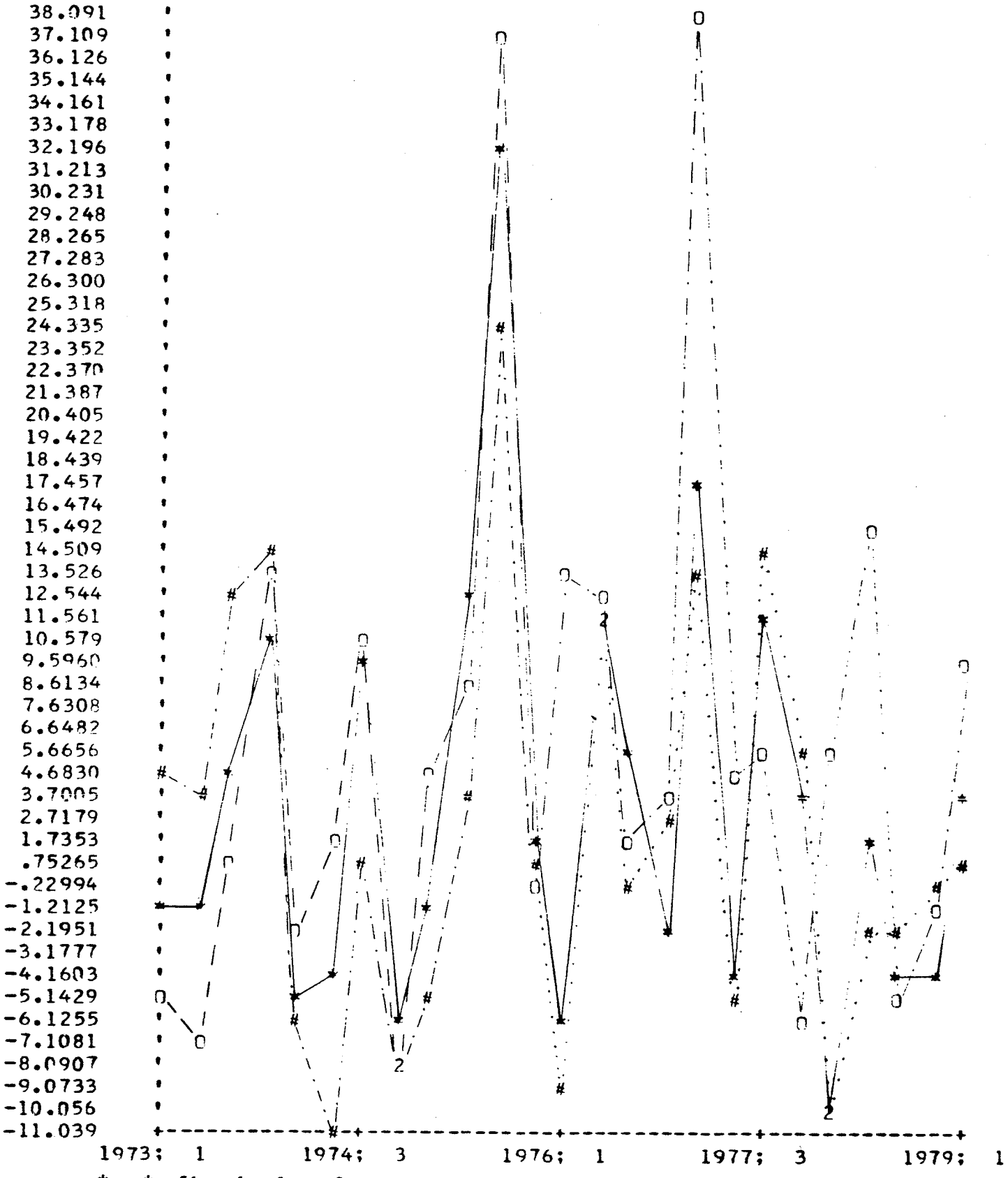
Residuals and Prediction Errors (%)

	A	B	C
	Residuals	Forecast Residuals/Prediction Errors	Backcast Prediction Errors/Residuals
1973;1	-6.63	-2.95	-12.69
2	.98	7.09	-3.25
3	-12.51	-8.38	-19.64
4	-.79	-4.00	-5.51
1974;1	3.94	.92	4.42
2	-1.14	-6.86	5.62
3	5.44	4.06	14.04
4	-.73	1.61	1.68
1975;1	3.56	-1.72	8.31
2	-14.11	-10.10	-5.17
3	9.55	4.71	17.50
4	2.24	4.32	2.64
1976;1	-10.25	-30.05	-6.92
2	-3.21	-3.39	-3.05
3	-7.28	-3.66	-1.88
4	5.03	-1.54	.16
1977;1	-5.37	-25.78	-1.28
2	3.01	-5.93	4.09
3	2.53	8.96	.36
4	2.31	11.61	.38
1978;1	-3.64	-18.90	-3.59
2	8.54	-5.47	12.23
3	7.23	8.99	5.71
4	5.88	2.74	1.32
1979;1	-.69	-7.18	2.24

over the "fixed rate" period and the repective forecast in column B and of the residual over the "flexible rate" period and the respective backcast in Column C. It is clear that the forecast underestimated the change in the black market rate whereas the backcast overestimated it. This is brought out by Figure 3 where the fitted values of the regression in Table 6 are plotted together with the in sample and outsample predictions of the regressions over the two subperiods.

The poor out of sample behavior, when the sample is roughly divided into two subperiods, does suggest that the real shock and policy changes make forecasting quite hazardous, relative even to an imperfect in sample behavior. But what seems remarkable is rather how the severe data limitations and structural changes do not prevent an in sample estimation of the rate of change of the black market rate in a simplified portfolio model.

Fitted Values, Forecasts and Backcasts from the Restricted Estimates



* —* fitted values from Table 6
0 -- 0 fitted values from Table 9 column A
0 -.-0 forecasts from Table 9 column A
#....# fitted values from Table 9 column B
-.-# backcasts from Table 9 column B

Conclusion

This may be the apropriate place to relate the main conclusion of the foregoing analysis, that the current account matters in the determination of the rate of change of the black market rate, to other findings about the Portuguese currency experience. Thus, it has been established that roughly one fifth of the variance of the change in the (official) effective exchange rate of the escudo could be explained by the current account and a constant and that a similar relationship held in real terms for the period 1936-1978.[8] It has also been shown that the official effective rate has moved according to relative purchasing power parity over the period 1973-1978[9], even though the real effective rate increased in the first half of the period and declined in the second, and that nominal wages have been such that the effective exchange rate has a positive elasticity of .5 on the real unit labor costs relative to Portugal's main trading partners.[10] In all of these findings, the basic mechanism at work was not made explicit. Inconvertibility, on the one hand and non-traded goods and trade restrictions on the other, made the "acceleration hypothesis" and "the law of one price" untenable in the Portuguese experience of 1973-78.

Here the hypothesis is that, given asset demands, the stock of foreign assets of the private sector, as captured by the current account and intervention in the official market, determine together with domestic credit creation the rate of change in the black market exchange rate of the Portuguese escudo. Despite measurement problems and lack of reliable data on the relevant stock of foreign assets, the estimation of the model leads to the acceptance of the hypothesis. Furthermore, the results imply

that the private sector wishes to be a net debtor in foreign currency and therefore, that the current account is positively related to the black market rate, whereas intervention is negatively related to it. The exploration of the feedback from the black market rate to the reported current account and the inclusion of alternative assets to offset the large negative value of the propensity to hold foreign assets as real financial wealth increases are immediate extensions of the present work. Despite its limitations, the results show that the portfolio approach is not only relevant for almost perfectly flexible rates as Branson et al (1977) and (1978) and Porter (1978) have shown, but that it can also be useful to understand exchange rate behavior with currency inconvertibility.

DATA APPENDIX

Sample period 1972;4-1979;1

1. BMER End of period (last Thursday of quarter) bid black market exchange rate in escudos per dollar in Lisbon. Source International Reports. Comparison with other sources quoted in Macedo (1979f) suggested corrections in 1973;3 (IR value = 21.83), 1978;3 (IR value = 54.05) and 1979;1 (IR value = 46.95). The first and last cases implied implausibly high negative black market premia and the case of 1978;3 seems to be a typo of IR, because the values in the neighboring weeks are more plausible.

2. OMEB End of period (last Thursday of quarter) bid official rate in escudos per dollar in New York. Source IR

3. M2 Money including time deposits in billion escudos from IFS, lines 34 + 35. This value includes some savings deposits excluded from the BP definition. There is a break in the series in 1976;4 due to the revision of monetary statistics.

4. CITINF Total domestic credit in billion escudoes, from IFS, lines 32 until 1975;3 and adjusted from the value in IFS after 1975;4. In that period IFS has a value which is implausibly higher (=434) and with no correspondence in the BP sources. After 1976;4 unrecoverable credits and estimates of BFN credit are netted out from BP data to maintain the earlier IFS definition. There may nevertheless still be a statistical break in this series.

5. NFABKSN Net foreign assets of the banking system in billion escudos from IFS, line 31. This series has been repeatedly revised in IFS and now corresponds to the BP definition. Only the central bank figure is adjusted for valuation changes due to the exchange rate.

6. CPIEXH Lisbon consumer price index excluding housing from INEBM and BPBT, rebased 1973;1 = 1, is much larger than the IFS figure, line 64, which includes housing subject to rent control.

7. NIPIX Industrial production index, corrected for weekdays and seasonnally adjusted, from BPBT, rebased 1973;1 = 1.

8. FAP Private stock of long term foreign assets. Series (13) cumulated with a base (the 1972; 4 value) from OECD balance of payments from 1960 to 1972.

9. FLP Private stock of long term foreign liabilities. Series (14) cumulated as forseries 8 .

10. NSFLP Net short term stock of foreign liabilities series (15) cumulated as for series (8).

11. NCABDOL Current account balance, in millions of dollars, 1973;1 - 1974;4 from RBP 1975 (figures in escudos converted at the average exchange rate) and from 1975:1 on from BTBP (figures in dollars). Differ from series (6) in Macedo (1979a).

12. NBNMT Balance on non-monetary transactions, in million dollars. Same sources as series (11).

13. LCOF Long term capital outflows of the private sector, in million dollars. Same source as series (11). The 1973 figures are not strictly comparable even with the 1974 figures because they rely on estimates of foreign direct investment and long term capital outflows alone.

14. LCIF Long term capital inflows of the private sector, in million dollars, same source as series (13)

15. NSCIF Net short term capital inflow, in million dollars, same source as series (13). Differ from the IFS data used in series (7) in Macedo (1979a).

16. GCPOXH Rate of growth of series (6) in percent per quarter.

17 GCPUS Rate of growth of U.S. consumer price index in percent per quarter.index based in 1975, from IFS, line 64.

18. GOMEB Rate of growth of series (2) in percent per quarter.

19. GROMEB Proportional rate of change in the real escudo dollar rate, in percent per quarter. Series (18) plus series (17) minus series (16).

20. GBMER Rate of growth of series (1) in percent per quarter.

21. GIP Rate of growth of series (7) in percent per quarter.

22. GIPUS Rate of growth of U.S. industrial production index, in percent per quarter. Index based in 1975, from IFS, line 66 ...

23. GRM2US Rate of growth of the real U.S. money stock, in percent per quarter. U.S. money stock, (M2) from IFS lines 34 + 35. Series (17) is subtracted from the rate of growth of M2US.

24. RDCITM2 Real domestic credit creation as a percentage or the money stock. Change in series (4) as a percentage of lagged value of series (3) divided by series (2) less series (16).

25. FMBB "Foreign monetary base" as a proportion of the money supply, series (11) as a percentage of the lagged value of (3) in million escudos divided by series (2).

26. GOMFMB Official exchange market pressure, in percent of the money supply. Series (18) minus series (25).

27. CABMR Current account as a percentage of the money supply. Series (11) as a percentage of the lagged value of series (3) in million escudos divided by series (2).

28. KLNFABK Net capital gains on the net stock of foreign assets of the banking system. Series (5) in million escudos divided by series (2) multiplied by series (17) in number per quarter, one period ahead.

29. KLNFAM2 Net capital gains as a percentage of money stock. Series (28) as a percentage of the lagged value of series (3) in million escudos, divided by series (1).

SAMPLE 1972. 4.-1979. 1.
NUMBER OF OBSERVATIONS = 26.

	BMEP	O OMEB	O M2	O CITINF	O NFARKSN O
1972. 4.	27.778	26.882	234.76	189.88	68.580
1973. 1.	25.641	25.120	243.51	199.12	70.230
1973. 2.	25.641	23.250	255.68	206.21	70.800
1973. 3.	23.750	23.310	272.23	220.97	74.490
1973. 4.	25.970	25.910	301.32	248.82	75.910
1974. 1.	25.640	24.810	300.93	258.20	70.900
1974. 2.	24.250	25.190	307.48	264.90	67.450
1974. 3.	27.780	25.770	319.56	277.23	66.660
1974. 4.	25.970	24.690	342.30	303.37	61.980
1975. 1.	26.670	24.240	341.60	308.82	56.280
1975. 2.	26.180	24.480	351.03	322.76	55.720
1975. 3.	37.040	27.490	364.56	335.83	47.780
1975. 4.	38.470	27.300	385.50	359.80	38.810
1976. 1.	32.260	29.160	389.31	370.10	29.220
1976. 2.	35.090	31.470	399.55	390.70	17.610
1976. 3.	34.480	31.150	420.47	412.60	17.690
1976. 4.	35.330	31.420	470.68	459.70	13.600
1977. 1.	39.680	38.830	484.03	489.50	-1.0900
1977. 2.	39.370	38.820	513.19	522.90	-15.350
1977. 3.	45.050	40.790	538.26	559.90	-24.580
1977. 4.	47.620	39.500	578.64	607.80	-22.860
1978. 1.	41.150	41.140	608.10	616.70	-34.050
1978. 2.	45.450	45.740	631.47	643.10	-41.580
1978. 3.	47.000	45.460	680.09	673.00	-26.430
1978. 4.	47.620	45.890	738.18	709.20	-7.8200
1979. 1.	49.000	48.255	765.29	742.19	-4.4100

SAMPLE 1973. 1.-1979. 1.
NUMBER OF OBSERVATIONS = 25.

	NCABDOL 0	NBNMT 0	LCOF 0	LCIF 0	NSCIF 0
1973. 1.	208.00	82.000	32.000	41.000	-152.00
1973. 2.	183.00	11.000	40.000	47.000	-13.000
1973. 3.	223.00	141.00	53.000	48.000	-19.000
1973. 4.	-80.000	111.00	49.000	41.000	231.00
1974. 1.	193.00	266.00	57.000	117.00	-543.00
1974. 2.	-142.00	188.00	81.000	228.00	-134.00
1974. 3.	46.000	51.000	73.000	171.00	-98.000
1974. 4.	-541.00	-230.00	70.000	113.00	296.00
1975. 1.	-168.00	-311.00	81.000	115.00	-156.00
1975. 2.	-232.00	-333.00	86.000	65.000	-64.000
1975. 3.	-69.000	-1122.0	103.00	87.000	1.0000
1975. 4.	-279.00	-258.00	76.000	61.000	47.000
1976. 1.	-364.00	-382.00	117.00	79.000	22.000
1976. 2.	-290.00	-435.00	88.000	84.000	-132.00
1976. 3.	-160.00	-27.000	113.00	118.00	130.00
1976. 4.	-435.00	-281.00	155.00	207.00	78.000
1977. 1.	-342.00	-399.00	143.00	89.000	12.000
1977. 2.	-438.00	-399.00	120.00	80.000	33.000
1977. 3.	-337.00	-388.00	107.00	131.00	-109.00
1977. 4.	-382.00	-251.00	126.00	215.00	31.000
1978. 1.	-433.00	-401.00	69.000	111.00	-27.000
1978. 2.	-410.00	-184.00	101.00	170.00	149.00
1978. 3.	16.000	397.00	116.00	140.00	114.00
1978. 4.	51.000	345.00	99.000	213.00	-61.000
1979. 1.	-67.000	54.000	129.00	188.00	4.0000

SAMPLE 1972. 4.-1979. 1.
NUMBER OF OBSERVATIONS = 26.

	CPIEXH 0	NIPIX 0	FAP 0	FLP 0	NSFLP 0
1972. 4.	.95450	96.090	170.00	808.00	125.00
1973. 1.	1.0000	100.00	202.00	849.00	-27.000
1973. 2.	1.0248	102.22	242.00	896.00	-40.000
1973. 3.	1.0572	106.76	295.00	944.00	-59.000
1973. 4.	1.1234	112.05	344.00	985.00	172.00
1974. 1.	1.2242	112.42	401.00	1102.0	-371.00
1974. 2.	1.3093	108.44	482.00	1330.0	-505.00
1974. 3.	1.4116	104.91	555.00	1501.0	-603.00
1974. 4.	1.4883	104.91	625.00	1614.0	-307.00
1975. 1.	1.5704	103.99	706.00	1729.0	-463.00
1975. 2.	1.6155	100.69	792.00	1794.0	-527.00
1975. 3.	1.6494	101.15	895.00	1881.0	-526.00
1975. 4.	1.7043	102.61	971.00	1942.0	-479.00
1976. 1.	1.8585	104.37	1088.0	2021.0	-457.00
1976. 2.	1.8518	106.28	1176.0	2105.0	-589.00
1976. 3.	1.9458	104.61	1289.0	2223.0	-459.00
1976. 4.	2.1445	111.97	1444.0	2430.0	-381.00
1977. 1.	2.3115	114.79	1587.0	2519.0	-369.00
1977. 2.	2.5207	118.10	1707.0	2599.0	-336.00
1977. 3.	2.4718	121.09	1814.0	2730.0	-445.00
1977. 4.	2.5094	124.16	1940.0	2945.0	-414.00
1978. 1.	2.6321	126.37	2009.0	3056.0	-441.00
1978. 2.	2.8126	126.69	2110.0	3226.0	-292.00
1978. 3.	2.9413	127.15	2226.0	3366.0	-178.00
1978. 4.	3.1279	131.14	2325.0	3579.0	-239.00
1979. 1.	3.3552	131.21	2454.0	3767.0	-235.00

SAMPLE 1973. 1.-1979. 1.
NUMBER OF OBSERVATIONS = 25.

	GCPCXH	0 GCPUS	0 GDMEB	0 GRDMEB	0 GBMEP	0
1973. 1.	4.7669	1.3977	-6.5536	-9.9229	-7.6932	
1973. 2.	2.4799	2.2557	-7.4442	-7.6685	-.29755E-03	
1973. 3.	3.1616	2.2059	.25799	-.69775	-7.3746	
1973. 4.	6.2618	2.3981	11.154	7.2902	9.3469	
1974. 1.	8.9727	2.6932	-4.2454	-10.525	-1.2706	
1974. 2.	6.9515	2.8506	1.5316	-2.5693	-5.4212	
1974. 3.	7.8133	3.1042	2.3025	-2.4066	14.557	
1974. 4.	5.4336	2.9032	-4.1909	-6.7213	-6.5156	
1975. 1.	5.5164	1.7764	-1.8225	-5.5625	2.6956	
1975. 2.	2.8719	1.5400	.99006	-.34179	-1.8372	
1975. 3.	2.0984	2.2243	12.296	12.422	41.482	
1975. 4.	3.3285	1.5827	-.69117	-2.4369	3.8606	
1976. 1.	9.0477	.97371	6.8132	-1.2608	-16.142	
1976. 2.	-.36048	1.2536	7.9219	9.5360	8.7726	
1976. 3.	5.0761	1.5236	-1.0169	-4.5694	-1.7384	
1976. 4.	10.212	1.1257	.86679	-8.2192	2.4651	
1977. 1.	7.7874	1.7627	23.584	17.559	12.313	
1977. 2.	9.0504	2.1876	-.25739E-01	-6.8885	-.78136	
1977. 3.	-1.9399	1.4274	5.0748	8.4421	14.427	
1977. 4.	1.5211	1.1434	-3.1625	-3.5402	5.7049	
1978. 1.	4.8896	1.6520	4.1519	.91424	-13.587	
1978. 2.	6.8576	2.5520	11.181	6.9757	10.450	
1978. 3.	4.5758	2.3332	-.61219	-2.8549	3.4105	
1978. 4.	6.3441	1.9545	.94590	-3.4437	1.3191	
1979. 1.	7.2669	2.5559	5.1528	.44187	2.8980	

SAMPLE 1973. 1.-1979. 1.
NUMBER OF OBSERVATIONS = 25.

	GIP	0 GIPUS	0 GRM2US	0 RUCITM2	0 FMBB	0
1973. 1.	4.0691	2.4000	-1.2221	-.83096	.93896	
1973. 2.	2.2199	1.4787	1.5824	.43165	.11347	
1973. 3.	4.4382	1.0018	-.65317	2.6112	1.2822	
1973. 4.	4.9566	.54103	2.8371	3.9685	.95045	
1974. 1.	.32888	-1.1659	-3.4829	-5.8598	2.2873	
1974. 2.	-3.5387	.90744	1.3996	-4.7251	1.5500	
1974. 3.	-3.2551	.62949	-2.6614	-3.8033	.41781	
1974. 4.	.32435E-02	-5.4513	2.5088	2.7464	-1.8548	
1975. 1.	-.87678	-9.1682	-3.3195	-3.9242	-2.2432	
1975. 2.	-3.1730	.83247	1.5067	1.2089	-2.3630	
1975. 3.	.45519	5.5727	-2.6792	1.6249	-7.8246	
1975. 4.	1.4388	2.4438	3.8150	3.2466	-1.9455	
1976. 1.	1.7164	3.3397	-1.5157	-6.3758	-2.7052	
1976. 2.	1.8352	1.8467	.80334	5.6519	-3.2582	
1976. 3.	-1.5740	1.1786	-1.4969	.40501	-.21266	
1976. 4.	7.0331	.80646	5.1059	.99004	-2.0818	
1977. 1.	2.5249	1.6889	-2.1521	-1.4561	-2.6635	
1977. 2.	2.8794	2.3601	.72539	-2.1500	-3.2009	
1977. 3.	2.5338	1.0248	-.67996	9.1497	-2.9350	
1977. 4.	2.5296	.67625	4.9500	7.3779	-1.9021	
1978. 1.	1.7857	.33586	-1.7895	-3.3515	-2.7374	
1978. 2.	.24934	3.0962	1.0674	-2.5163	-1.2448	
1978. 3.	.36271	1.9480	-1.9569	.15916	2.8756	
1978. 4.	3.1394	1.8312	4.2755	-1.0213	2.3061	
1979. 1.	.54525E-01	1.0164	-5.1094	-2.7978	.33570	

SAMPLE 1973. 1.-1979. 1.
NUMBER OF OBSERVATIONS = 25.

	CABMR 0	GOMEMR 0	KLNEABK 0	KLNEAM2 0
1973. 1.	2.4612	-7.4926	35.657	.42192
1973. 2.	1.9269	-7.5577	63.063	.66404
1973. 3.	2.2364	-1.0242	67.172	.67364
1973. 4.	-.69794	10.204	76.634	.66857
1974. 1.	1.6634	-6.5327	78.905	.68006
1974. 2.	-1.2099	-.18354E-01	81.463	.69408
1974. 3.	.36279	1.8847	83.121	.65554
1974. 4.	-4.7030	-2.3362	75.098	.65284
1975. 1.	-1.2746	.42070	44.593	.33832
1975. 2.	-1.8113	3.3530	35.756	.27916
1975. 3.	-.51461	20.120	50.629	.37759
1975. 4.	-2.8347	1.2543	27.509	.27950
1976. 1.	-3.6324	9.5184	13.842	.13814
1976. 2.	-2.4031	11.180	12.562	.10410
1976. 3.	-1.4052	-.80420	8.5258	.74877E-01
1976. 4.	-3.5671	2.9485	6.3929	.52424E-01
1977. 1.	-2.5671	26.247	7.6298	.57270E-01
1977. 2.	-3.5907	3.1751	-.61409	-.50342E-02
1977. 3.	-2.5853	8.3098	-5.6443	-.43301E-01
1977. 4.	-3.1972	-1.2604	-6.8900	-.57667E-01
1978. 1.	-3.5634	6.3892	-9.5606	-.78680E-01
1978. 2.	-2.7745	12.426	-21.950	-.14853
1978. 3.	.11516	-3.4878	-21.210	-.15266
1978. 4.	.35245	-1.3602	-11.363	-.78531E-01
1979. 1.	-.43222	4.8171	-4.3555	-.28097E-01

Footnotes

[1]Kouri (1978) has a partial equilibrium model of two-way currency substitution. Inflation is briefly discussed on pp. 38-39.

[2]See the discussion of the restrictions on these functions in Tobin (1969) and Tobin-Macedo (1979).

[3]See evidence on this hypothesis in Macedo (1979d).

[4]The term is borrowed from Girton-Roper (1977).

[5]See Macedo (1979b) for a model along these lines.

[6]See a critical review of these models in Macedo (1979b).

[7]In Macedo (1979a, Sec. III. 3) the level of the black market premium was regressed on domestic money and the net stock of foreign assets of the private sector obtained by cumulating the short term capital account and errors and omissions (similar to series 15 in the Appendix). This stock, which was negative over the whole sample period, cannot, however, be taken to reveal that there was borrowing in foreign currency, so that the assumption of no foreign demand for domestic assets had to be made. As the sum of series (13) and (14) in the Appendix shows, the level of long term gross investment in Portugal is sizable and the fact that the value is negative when the short term account is properly measured suggests that the capital mobility is indeed larger than most people anticipated. Similar emphasis on the Portuguese capital account can be found in Barbosa-Beleza (1979).

[8]See Macedo (1979c).

[9]See Macedo (1979e).

[10]See Krugman-Macedo (1979) and Macedo (1979g).

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